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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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09/610,637

07/05/2000

Koichiro Tanaka

SEL 191

3873

7590

10/13/2004

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EXAMINER

BLUM, DAVID S

ART UNIT

PAPER NUMBER

2813

DATE MAILED: 10/13/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/610,637

Applicant(s)

TANAKA ET AL.

Examiner

David S Blum

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 04 August 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 61-85 is/are pending in the application.
- 4a) Of the above claim(s) 61-66 and 76-85 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 67-75 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☒ Claim(s) 61-85 are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 05 July 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 8/4/04.
- 4) ☐ Interview Summary (PTO-413) Paper No(s) _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

This action is in response to remarks paper filed 8/4/04.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 67-70 and 74 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sakurai (US4659422) in view of Wakita (US005960323A).

Sakurai teaches all of the processing steps of claims 67-70 and 74 except for the laser beams being linear or band shaped, the substrates orientation with gravity, and for the substrate moving along its width in relation to the laser beams. Sakurai teaches (figure 2 and column 2 lines 55-56) simultaneously irradiating the front and back side of a wafer the irradiation regions of the first and second beams being parallel with each other (figure 2). Sakurai's heat source is not a laser beam, but a different light source. Wakita teaches the use of a laser beam to heat treat a substrate and its advantages. In particular, Wakita teaches using a laser beam in order to heat treat/crystallize at lower temperatures and thus use less expansive substrates (column 1 lines 47-60).

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Sakurai is silent as to the shape of the beam although column 3 lines 1-2 suggest that the shape may be either linear and band, or different sized bands and that the beam is moved in a direction along the substrate length (column 3 line 10). Wakita teaches a linear beam (line beam, column 6 line 21), with the line beam moved in the direction of the width (column 6 lines 25-26). Although the claim limitation recites moving the substrate, Wakita is considered to read on the limitation as the beam and the substrate are moving along the width relative to each other, and the same result would occur. Wakita also teaches the substrate is mounted in a stage that is moveable in the x and y directions (column 7 lines 51-55), suggesting movement of the substrate along the width.

The material of Sakurai is polysilicon (column 3 line 63) as in claim 68 (non-single crystal semiconductor film). The energy of the two beams may be the same (as described in column 3 lines 25-28) or the second beam may be of a lower power (column 3 lines 2-3), suggesting that the energy from the front surface laser beam could be higher than that of the energy from the back surface laser beam as in claim 68. This also suggests that the energy ratio of the front side laser to that of the backside laser could be between 1:1 and 10:1 as in claim 69.

Regarding claim 70, where the limitation is on the substrate arranged in a direction parallel to the direction of gravity, Wakita shows the substrate perpendicular to the direction of gravity (figure 7) and parallel to the direction of gravity (figure 9) as shown

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by the substrates relation to lens 57. thus Wakita teaches an art recognized equivalence to the substrates orientation to gravity.

Regarding claim 74, where the first and second lasers are excimer lasers, Wakita teaches the use of (pulsed) excimer lasers (column 6 line 10).

It would be obvious to one skilled in the requisite art at the time of the invention to modify Sakurai by using a laser beam to heat treat a substrate as taught by Wakita to heat treat/crystallize at lower temperatures and thus use less expansive substrates (column 1 lines 47-60) and orientating the substrate parallel to gravity, using a linear beam, and moving the substrate along it's width as taught by Wakita to produce a larger more uniform crystal size (Wakita, column 4 lines 53-54).

3. Claims 72-73 and 75 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sakurai (US04659422) in view of Wakita (US005960323A) as applied to claim 67 above, and further in view of Im.

Sakurai and Wakita teach all of the positive steps of claims 72-73 and 75 as recited above, except for the presence of hydrogen in the annealing atmosphere, the temperature of the irradiated region being between 10 and 500 degrees C, and the lasers being XeCl lasers.

Regarding claim 72, Sakurai and Wakita are silent as to the atmosphere containing hydrogen. Im teaches the use of oxygen or in the alternative hydrogen in the

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atmosphere. Im teaches the presence of hydrogen creates explosive crystallization (page 5), a goal of Talwar (abstract).

Regarding claim 73, Sakurai teaches heating the region to above the substrate to 1500 degrees (column 4 line 9) but is silent as to the substrate temperature itself. Wakita teaches 600 degrees or less, thus suggesting less than 500 degrees. Im teaches room temperature to 550 degrees to recrystallize amorphous silicon (page 3).

Regarding claim 75, Sakurai and Wakita are silent as to the type of excimer laser used. Im teaches that it is known to use an XeCl laser to crystallize amorphous silicon (page 3).

It would be obvious to one skilled in the requisite art at the time of the invention to modify Sakurai and Wakita by using an XeCl laser, recrystallize at 10-500 degrees C. and irradiate in the presence of hydrogen to produce a larger more uniform crystal size (Wakita, column 4 lines 53-54; Im page 4) and achieve superior quality crystal structure (Sakurai column 2 lines 63-65; Im page 5).

4. Claim 71 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sakurai (US4659422) in view of Wakita (US005960323A) as applied to claim 67 above, and further in view of Kudo (JP 09-186336).

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Sakurai and Wakita teach all of the positive steps of claim 70, except for the atmosphere having a pressure between atmospheric pressure and 10^{-3} Pa.

Sakurai and Wakita are silent as to the pressure, thus one would argue that absence any teaching to the contrary, the pressure is that of atmospheric pressure. Kudo teaches crystallizing amorphous silicon, using an excimer laser at atmospheric pressure (paragraph 0009).

Kudo clarifies that at the time of Sakurai and Wakita, it was known to irradiate at atmospheric pressures and their silence is indicative of their using atmospheric pressure.

Response to Arguments

5. Applicant's arguments filed 8/4/04 have been fully considered but they are not persuasive.

The applicant argues that Sakurai does not teach the use of a laser beam and Wakita does not simultaneously irradiate the wafer from both the front and back sides. Sakurai teaches simultaneously irradiating the wafer from both the front and back sides. The heat source is a high temperature lamp (thus beams) but not a laser beam. Wakita teaches the use of laser beams as heat sources to heat wafers and the advantages of using the laser beam. In light of Wakita, one skilled in the requisite art would know the benefits of using laser beams as the heat source in the process of Sakurai.

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In regards to claims 72-73 and 75, the applicant argues that Sakurai does not teach the use of a laser beam and Wakita and Im do not simultaneously irradiate the wafer from both the front and back sides. Sakurai teaches simultaneously irradiating the wafer from both the front and back sides. The heat source is a high temperature lamp (thus beams) but not a laser beam. Wakita teaches the use of laser beams as heat sources to heat wafers and the advantages of using the laser beam. In light of Wakita, one skilled in the requisite art would know the benefits of using laser beams as the heat source in the process of Sakurai.

In regards to claim 71, the applicant argues that Sakurai does not teach the use of a laser beam and Wakita and Kudo do not simultaneously irradiate the wafer from both the front and back sides. Sakurai teaches simultaneously irradiating the wafer from both the front and back sides. The heat source is a high temperature lamp (thus beams) but not a laser beam. Wakita teaches the use of laser beams as heat sources to heat wafers and the advantages of using the laser beam. In light of Wakita, one skilled in the requisite art would know the benefits of using laser beams as the heat source in the process of Sakurai.

Conclusion

6. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

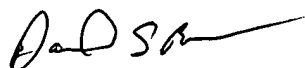
A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to David S. Blum whose telephone number is (571)-272-1687) and e-mail address is David.blum@USPTO.gov.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead Jr., can be reached at (571)-272-1702. Our facsimile number all patent correspondence to be entered into an application is (703) 872-9306. The facsimile number for customer service is (703)-872-9317.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



David S. Blum

October 12, 2004